

COMMUNICATIONS SPECIFICATION INDEX

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SECTION 27 00 01

COMMUNICATIONS REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. All sections of Division 27 shall comply with this section. The standards established in this section as to quality of materials and equipment, the type and quality of workmanship, mode of operations, safety rules, code requirements, etc., shall apply to all sections of this Division as though they were repeated in each Division.
- C. Architectural, Mechanical, Civil, Structural, and other applicable documents also apply to work of this section.

1.2 SUMMARY

- A. Provide all labor, materials, and equipment as required for a complete operating and tested communications system as described in the contract documents. Raceways and junction boxes will be provided by Division 26. Provide all horizontal cabling for teledata and security cameras. and make final terminations. Provide hooks to support cabling where not in raceway. Cabling is required to be in raceway in spaces with exposed ceiling.

1.3 CODES & ORDINANCES

- A. All work shall be executed in accordance with all underwriters, public utilities, local and state codes, rules, and regulations applicable to the trade affected. Where work required by the drawings or specifications exceeds the codes rules, and regulations, it shall be done according to the documents. Where conflicts occur, the most stringent requirements shall apply.
- B. Applicable codes: Work shall comply with currently adopted Edition:
 - 1. International Building code
 - 2. International Fire Code
 - 3. International Energy Code
 - 4. National Electrical Code

1.4 INDUSTRY STANDARDS

- A. All work and equipment shall comply with the following standards. These standards refer to the latest adopted or published edition. Where conflicts occur, the most stringent requirement shall apply.
 - 1. ETL Testing Laboratories (ETL)
 - 2. Institute of Electrical and Electronic Engineers (IEEE)
 - 3. National Fire Protection Association (NFPA)
 - 4. National Electrical Manufacturers Association (NEMA)
 - 5. Utah Safety Standard (OSHA), Utah State Industrial Council.
 - 6. Underwriters Laboratories (UL)
 - 1. Certified Ballast Manufacturers (CBM)
 - 2. American Society for testing Materials (ASTM)
 - 3. Insulated Cable Engineers Association (ICEA)
 - 7. American National Standards Institute (ANSI)
 - 8. EIA/TIA
- B. Compliance Verification:
 - 1. Manufactured equipment which is represented by a UL classification and/or listing, shall bear the UL or equivalent ETL label.

1.5 INTERPRETATION OF DRAWINGS

- A. Carefully review the documents prior to bid. Submit requests for clarification to the Architect/Engineer in writing prior to final addendum. Discrepancies or conflicts in the construction documents not brought forward to the Engineer prior to the final addendum will not be eligible for a change order during construction. The contractor should include the amount of the higher cost requirement in their bid.
- B. Electric equipment is shown at a small scale, and is shown at its approximate location only. The drawings shall not be scaled for roughing in measurements, except where dimensions are specifically shown. Refer to the Architectural and Mechanical drawings, and coordinate with applicable shop drawings of other trades, to locate electrical equipment. Coordinate with other trades to avoid interferences, and to provide sufficient space for the installation of all equipment. Where conflicts occur, notify the Architect in writing, for clarification.
- C. Visit the site prior to bid to determine how existing conditions shall affect the electrical installation. Include all costs required due to existing site conditions in the bid.

1.6 DEFINITIONS

- A. Provide: Furnish, install, and connect, unless noted otherwise.
- B. Furnish: Purchase and deliver to the site. Include all essential items for performing the function.
- C. Install: Physically install the equipment per industry standards, codes, and Contract Documents.
- D. Connect: Make final connections to the equipment, and place into operation per manufacturer's instructions.

1.7 SAFETY REGULATION

- A. Comply with all local, State, Federal, and OSHA safety requirements in performance with this work. Refer to the General Conditions. Provide equipment, supervision, construction, procedures, and all other necessary items to assure safety to life and property.

1.8 SUBMITTALS AND SHOP DRAWINGS

- A. As soon as possible after the contract is awarded, the Contractor shall submit to the Architect, the manufacturer's data on products and materials, and shop drawings, to be used in the installation of electrical systems for this project. Review of the submitted data will require a minimum of **14 days**. The first day starts after the day they are received in the Engineer's office. If the Contractors schedule requires return of submitted literature in less than the allotted time, the Contractor shall accelerate his submittal delivery date. The Contractor shall resubmit all items requiring re-review within **14 days** of returned submittals. Refer to each specification section for items requiring submittal review.
- B. Written approval of the Owner's Representative shall be obtained before installing any equipment or materials for the project. Review of the submittals by the Owner's Representative is for general conformance with the Contract Documents and shall not relieve the Contractor from compliance with the Contract Documents.
- C. Verify all dimensional information to insure proper clearance for installation of equipment. Submitted literature shall bear the Contractor's stamp, indicating that he has reviewed all equipment being submitted; that each item will fit within the available space. Notify the Architect, in writing, for additional instructions where proposed equipment is found to be in conflict with available space.
- D. By description, catalog number, and manufacturer's names, standards of quality have been established by the Architect and the Engineer for certain

manufactured equipment items and specialties that are to be furnished by this Division. Alternate products and equipment may be proposed for use only if specifically named in the specifications, or if given written prior approval in published addenda. Design equipment is the equipment listed on the drawings, or if not listed on the drawings is the equipment first named in the specifications.

- E. If the Engineer is required to do additional design work to incorporate changes caused by submitting equipment or products different than the design equipment specified as defined above, or design issues caused by installation errors, the contractor shall reimburse the engineer for additional time and expenses at the engineer's current, recognized, hourly rates.
- F. Submittal Format: Unless noted otherwise in the General Conditions, the project submittals may be submitted in electronic format as noted below. Partial submittals will not be reviewed until the complete submittal is received. Provide copies of the descriptive literature covering products and materials to be used in the installation of electrical systems for this project for review.
 - 1. Electronic Submittal Format: Assemble complete submittal package into a single indexed file incorporating submittal requirements of a single specification section and transmittal form with links enabling navigation to each item. Name file with submittal number or other unique identifier, including revision identifier. Electronic file shall be completely electronically searchable with bookmarks for each submittal section and device/fixture type or it will be rejected. Provide means for insertion to permanently record Contractor's review and approval markings and action taken by the Architect
 - 2. The title sheet of the submittal shall contain the project name, date of submission, Architect, Contractor, Sub Contractors, Suppliers, specification section number and title.
 - 3. Provide a statement on the title sheet that the shop drawings comply with, and are submitted in accordance with the contract documents.
 - 4. Provide manufacturer's equipment cut sheets, brochures, and drawings which describe the proposed equipment. All relevant information shall be identified.
 - 5. Submit electrical room layouts for all electrical rooms showing equipment dimensions and required clearances.
 - 6. The drawings shall not be scaled for roughing in measurements nor shall they be used as shop drawings. Where drawings are required for these purposes or where drawings must be made from field measurements, the Contractor shall take the necessary measurements and prepare the drawings. Shop drawings of the various subcontractors shall be coordinated to eliminate all interferences and to provide sufficient space for the installation of all equipment.

G. ENGINEERING COMPENSATION

1. The contractor shall reimburse the engineer for additional time and expenses at the engineer's current, recognized, hourly rates if the Engineer is required to do additional design work to incorporate changes caused by the following:
 - a. Submitting equipment or products different than the design equipment specified
 - b. Design issues caused by installation errors or contractor neglect
 - c. Value engineering substitutions not approved by the Engineer

1.9 OPERATING AND MAINTENANCE MANUALS

- A. Unless noted otherwise in the General Conditions, submit one (1) copy in PDF format. Follow same compilation format as listed for Electronic Submittal Format.
- B. Provide manufacturer's operating and maintenance instructions. Provide vendor's name, address, and phone number. List model and serial number for each piece of equipment. Include list of replacement parts and service schedules. Provide wiring diagrams and manufacturer's warranties.

1.10 RECORD DRAWINGS

- A. Refer to the General Conditions for As-Built Drawing submission requirements.
- B. Keep one complete hard copy set of the contract documents on site. Record on a daily basis, any modifications to the documents due to addendums, changes, and field conditions. Show dimensions for concealed work including conduits buried below slab or below grade, concrete ductbanks, direct burial cable, utility lines, etc.

1.11 WARRANTY

- A. In addition to the requirements of the General Conditions, warranty the complete electrical installation to be in accordance with the contract documents, to be free from defects and in proper working order. Repair or replace any defective equipment or installation for a period of one (1) year from the date of final acceptance, or as noted otherwise.
- B. Submit written warranties and guarantees. List the Project name and the Contractor's business name and contact information.
- C. Submit warranty information for each product including name, address, and telephone number of warranty service. Include procedures for filing a claim.

PART 2 - PRODUCTS

2.1 GENERAL

- A. All materials shall be new unless specifically noted otherwise.

2.2 SUBSTITUTIONS:

- A. Substitutions of specified products, approved installers, etc. may be considered prior to bid. Submit proposed substitutions a minimum of eight (8) working days prior to the bid date. Provide complete information for proposed equipment including catalog cut sheets. Certify that the proposed equipment is equal to the specified equipment. Where substitution of a proposed installer is requested, submit company/installer's resume indicating years of experience, certifications, etc. Any allowed substitutions shall be included in the addendum. Do not bid unapproved equipment or work by unapproved installers.
- B. Provide samples as requested by the Architect/Engineer for review of proposed equipment prior to bid.
- C. Substituted equipment shall comply with the intent of the contract documents. The Contactor shall bear all costs arising from conflicts arising due to the use of substituted equipment.
- D. Value engineering substitutions shall not be offered by the Contractor without a request from the Architect/Engineer. Vendors offering value engineered product substitutions, without the permission and involvement of the Architect/Engineer, shall be forfeited from bidding future projects.

2.3 SPARE PARTS

- A. Provide spare parts as specified in Divisions 27 sections. Deliver spare parts to the Owner's Representative prior to substantial completion. Obtain written receipt and include with as-built drawing submission.

PART 3 - EXECUTION

3.1 CUTTING AND PATCHING

- A. No cutting or drilling of structural members shall be done without written approval of the Architect. The work shall be carefully laid out in advance, and cutting, channeling, chasing, or drilling of floors, walls, partitions, ceilings, or other surfaces necessary for the electrical work shall be carefully done. Any damage to building, piping, or equipment shall be repaired by professional

plasterers, masons, concrete workers, etc., and all such work shall be paid for as work of this Division.

- B. When concrete, asphalt, grading landscaping, etc., is disturbed, it shall be restored to original condition as described in the applicable Division of this Specification.
- C. Provide roof jacks and flange extending a minimum of 9 inches under roofing materials, for raceways and cables which penetrate the roof. Seal opening with approved sealant. Provide drip loop for cables, and weather head on raceway, which penetrates the roof. Coordinate installation requirements with Division 7.
- D. Seal and caulk as required to waterproof all conduit penetrations. Any penetrations through vapor barriers shall be made vapor tight. See Division 7, Thermal and Moisture Protection for material and installation requirements.

3.2 ACCESS

- A. Provide access doors in walls, ceilings and floors for access to electrical equipment such as junction boxes, pull boxes, cable trays, etc. Refer to Division 8 for door specifications. All access doors shall be 24" x 24" unless noted otherwise. Coordinate location of doors with the Architect prior to installation. If doors are not specified in Division 8, provide the following: Doors in ceilings and wall shall be equal to JR Smith No. 4760 bonderized and painted. Doors in tile walls shall be equal to JR Smith No. 4730 chrome plated. Doors in floors shall be equal to JR Smith No. 4910.
- B. Provide block-outs, sleeves, demolition work, etc., required for installation of work specified in this Division.

3.3 CLEANING AND PAINTING

- A. Upon completion of all tests and adjustments, and all systems have been pronounced satisfactory for permanent operation, clean all exposed raceway, junction boxes, pullboxes, fixtures, etc. and leave them ready for painting. Refinish any damaged finish, and leave everything in proper working order.
- B. Remove all stains, finger marks, and grease marks on walls, floors, glass, hardware, fixtures, or elsewhere, caused by work of this Division. Clean light fixtures and interior and exterior of all electrical equipment.
- C. Painting of exposed raceway, junction boxes, pullboxes, surface metal raceway, etc., is work of Division 9, Painting.
- D. All equipment which is indicated to be furnished in factory prefinished conditions, and painted by the Electrical Contractor shall be left without mark,

scratch, or impairment to finish upon completion of job. Any necessary refinishing to match original shall be done. Do not paint over nameplates, serial numbers, or other identifying marks.

- E. Upon completion of work of this Division, remove all surplus material and rubbish resulting from this work, and leave the premises in a clean and orderly condition.

3.4 PROTECTION AGAINST WEATHER AND STORING OF MATERIALS

- A. All equipment and materials shall be properly stored and protected against damage, theft, moisture, dust, and wind. Coverings or other protection shall be used on all items that may be damaged or rusted or may have performance impaired by adverse weather or moisture conditions. Damage or defect developing before acceptance of the work shall be made good at the Contractor's expense.

3.5 EQUIPMENT STARTUP AND TESTING:

- A. Each major piece of equipment shall be started and tested by an authorized representative of the equipment manufacturer. A certificate indicating the equipment is operating to the satisfaction of the manufacturer shall be provided, and shall be included with the Warranty.
- B. Notify Architect/Engineer prior to all testing for this Division, a minimum of three (3) business days prior to testing. Engineer shall observe all tests to insure the proper operation of the electrical system.
- C. The Manufacturer's Representative shall provide instructions to the owner's maintenance personnel for operation and maintenance of the equipment.

3.6 FINAL REVIEW:

- A. The Project Forman shall accompany the Engineer and remove coverplates, panelboard covers, access panels, etc. as requested, to allow review of the entire electrical system.

END OF SECTION 26 0100

SECTION 27 05 28

PATHWAYS FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Hooks.

1.2 ACTION SUBMITTALS

- A. Product data for each type of product.
- B. Shop Drawings: For custom enclosures and cabinets. Include plans, elevations, sections, and attachment details.

PART 2 - PRODUCTS

2.1 HOOKS

- A. Description: Prefabricated sheet metal cable supports for telecommunications cable.
- B. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to the following:
1. MonoSystems, Inc.
 2. Panduit Corp.
 3. Wiremold; Legrand North America, LLC.
- C. Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application.
- D. Comply with TIA-569-D.
- E. Galvanized steel.
- F. U shape.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with the following standards for installation requirements except where requirements on Drawings or in this Section are stricter:
 - 1. NECA 1.
 - 2. NECA/BICSI 568.
 - 3. TIA-569-D.
 - 4. NECA 101
 - 5. NECA 102.
 - 6. NECA 105.
 - 7. NECA 111.
- B. Keep cables at least 12 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal pathway runs above water and steam piping.
- C. Hooks:
 - 1. Size to allow a minimum of 25 percent future capacity without exceeding design capacity limits.
 - 2. Shall be supported by dedicated support wires. Do not use ceiling grid support wire or support rods.
 - 3. Hook spacing shall allow no more than 6 inches (150 mm) of slack. The lowest point of the cables shall be no less than 6 inches (150 mm) adjacent to ceilings, mechanical ductwork and fittings, luminaires, power conduits, power and telecommunications outlets, and other electrical and communications equipment.
 - 4. Space hooks no more than 5 feet (1.5 m) o.c.
 - 5. Provide a hook at each change in direction.

3.2 FIRESTOPPING

- A. Install firestopping at penetrations of fire-rated floor and wall assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."

END OF SECTION 270528

SECTION 27 11 00

COMMUNICATIONS EQUIPMENT ROOM FITTINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Telecommunications mounting elements.
2. Backboards.
3. Telecommunications equipment racks and cabinets.
4. Power strips.
5. Grounding.

B. Related Requirements:

1. Section 271513 "Communications Copper Horizontal Cabling" for copper data cabling associated with system panels and devices.
2. Section 280513 "Conductors and Cables for Electronic Safety and Security" for voice and data cabling associated with system panels and devices.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For communications equipment room fittings. Include plans, elevations, sections, details, and attachments to other work.

1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
2. Equipment Racks and Cabinets: Include workspace requirements and access for cable connections.
3. Grounding: Indicate location of grounding bus bar and its mounting detail showing standoff insulators and wall mounting brackets.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified layout technician, installation supervisor, and field inspector.

B. Seismic Qualification Certificates: For equipment frames from manufacturer.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Cabling Installer must have personnel certified by BICSI on staff.
 - 1. Layout Responsibility: Preparation of Shop Drawings shall be under the direct supervision of Commercial Installer, Level 2.
 - 2. Installation Supervision: Installation shall be under the direct supervision of Level 2 Installer, who shall be present at all times when Work of this Section is performed at Project site.
 - 3. Field Inspector: Currently registered by BICSI as Commercial Installer, Level 2 to perform the on-site inspection.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Equipment frames shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
 - 1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

2.2 BACKBOARDS

- A. Backboards: Plywood, fire-retardant treated, **3/4 by 48 by 96 inches (19 by 1220 by 2440 mm)**. Comply with requirements for plywood backing panels specified in Section 061000 "Rough Carpentry."

2.3 EQUIPMENT FRAMES

- A. **Products:** Subject to compliance with requirements, provide one of the following:
 - 1. AMP NETCONNECT; a TE Connectivity Ltd. company.
 - 2. Belden Inc.
 - 3. B-line; Eaton, Electrical Sector.
 - 4. Emerson Network Power Connectivity Solutions.
 - 5. Hubbell Premise Wiring; Hubbell Incorporated, Commercial and Industrial.
 - 6. Leviton Manufacturing Co., Inc.
 - 7. Middle Atlantic Products; Legrand North America, LLC.
 - 8. Siemon Co. (The).

B. General Frame Requirements:

1. Distribution Frames: Freestanding and wall-mounting, modular-steel units designed for telecommunications terminal support and coordinated with dimensions of units to be supported.
2. Module Dimension: Width compatible with EIA 310-D standard, 19-inch (480-mm) panel mounting.
3. Finish: Manufacturer's standard, baked-polyester powder coat.

C. Floor-Mounted Racks: Modular-type, steel construction.

1. Vertical and horizontal cable management channels, top and bottom cable troughs, grounding lug, and a power strip.
2. Baked-polyester powder coat finish.

D. Modular Freestanding Cabinets:

1. Removable and lockable side panels.
2. Hinged and lockable front and rear doors.
3. Adjustable feet for leveling.
4. Screened ventilation openings in the roof and rear door.
5. Cable access provisions in the roof and base.
6. Grounding bus bar.
7. Rack-mounted, 550-cfm (260-L/s) fan with filter.
8. Power strip.
9. Baked-polyester powder coat finish.
10. All cabinets keyed alike.

E. Modular Wall Cabinets:

1. Wall mounting.
2. Steel construction.
3. Treated to resist corrosion.
4. Lockable front doors.
5. Louvered side panels.
6. Cable access provisions top and bottom.
7. Grounding lug.
8. Roof-mounted, 250-cfm (118-L/s) fan.
9. Power strip.
10. All cabinets keyed alike.

F. Cable Management for Equipment Frames:

1. Metal, with integral wire retaining fingers.
2. Baked-polyester powder coat finish.
3. Vertical cable management panels shall have front and rear channels, with covers.

4. Provide horizontal crossover cable manager at the top of each relay rack, with a minimum height of two rack units each.

2.4 POWER STRIPS

A. Power Strips: Comply with UL 1363.

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Rack mounting.
3. Six, 20-A, 120-V ac, NEMA WD 6, Configuration 5-20R receptacles.
4. LED indicator lights for power and protection status.
5. LED indicator lights for reverse polarity and open outlet ground.
6. Circuit Breaker and Thermal Fusing: When protection is lost, circuit opens and cannot be reset.
7. Circuit Breaker and Thermal Fusing: Unit continues to supply power if protection is lost.
8. Close-coupled, direct plug-in line cord.
9. Rocker-type on-off switch, illuminated when in on position.
10. Peak Single-Impulse Surge Current Rating: 33 kA per phase.
11. Protection modes shall be line to neutral, line to ground, and neutral to ground. UL 1449 clamping voltage for all three modes shall be not more than 330 V.

2.5 GROUNDING

A. Comply with requirements in Section 270526 "Grounding and Bonding for Communications Systems" for grounding conductors and connectors.

B. Telecommunications Main Bus Bar:

1. Connectors: Mechanical type, cast silicon bronze, solderless exothermic-type wire terminals, and long-barrel, two-bolt connection to ground bus bar.
2. Ground Bus Bar: Copper, minimum 1/4 inch thick by 4 inches wide (6 mm thick by 100 mm wide) with 9/32-inch (7.14-mm) holes spaced 1-1/8 inches (28 mm) apart.
3. Stand-Off Insulators: Comply with UL 891 for use in switchboards, 600 V. Lexan or PVC, impulse tested at 5000 V.

C. Comply with TIA-607-B.

2.6 LABELING

- A. Comply with TIA-606-B and UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

PART 3 - EXECUTION

3.1 ENTRANCE FACILITIES

- A. Contact telecommunications service provider and arrange for installation of demarcation point, protected entrance terminals, and a housing when so directed by service provider.
- B. Comply with requirements in Section 270528 "Pathways for Communications Systems" for materials and installation requirements for underground pathways.

3.2 INSTALLATION

- A. Comply with NECA 1.
- B. Comply with BICSI TDMM for layout and installation of communications equipment rooms.
- C. Bundle, lace, and train conductors and cables to terminal points without exceeding manufacturer's limitations on bending radii. Install lacing bars and distribution spools.
- D. Coordinate layout and installation of communications equipment with Owner's telecommunications and LAN equipment and service suppliers. Coordinate service entrance arrangement with local exchange carrier.
 - 1. Meet jointly with telecommunications and LAN equipment suppliers, local exchange carrier representatives, and Owner to exchange information and agree on details of equipment arrangements and installation interfaces.
 - 2. Record agreements reached in meetings and distribute them to other participants.
 - 3. Adjust arrangements and locations of distribution frames, cross-connects, and patch panels in equipment rooms to accommodate and optimize arrangement and space requirements of telephone switch and LAN equipment.
 - 4. Adjust arrangements and locations of equipment with distribution frames, cross-connects, and patch panels of cabling systems of other communications, electronic safety and security, and related systems that share space in the equipment room.

- E. Coordinate location of power raceways and receptacles with locations of communications equipment requiring electrical power to operate.

3.3 SLEEVE AND SLEEVE SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

- A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 270544 "Sleeves and Sleeve Seals for Communications Pathways and Cabling."

3.4 FIRESTOPPING

- A. Comply with requirements in Section 078413 "Penetration Firestopping."
- B. Comply with TIA-569-D, Annex A, "Firestopping."
- C. Comply with BICSI TDMM, "Firestopping Systems" Article.

3.5 GROUNDING

- A. Install grounding according to BICSI TDMM, "Grounding, Bonding, and Electrical Protection" Chapter.
- B. Comply with TIA-607-B.
- C. Locate grounding bus bar to minimize the length of bonding conductors. Fasten to wall allowing at least 2-inch (50-mm) clearance behind the grounding bus bar. Connect grounding bus bar with a minimum No. 4 AWG grounding electrode conductor from grounding bus bar to suitable electrical building ground.
- D. Bond metallic equipment to the grounding bus bar, using not smaller than No. 6 AWG equipment grounding conductor.
 - 1. Bond the shield of shielded cable to the grounding bus bar in communications rooms and spaces.

3.6 IDENTIFICATION

- A. Identify system components, wiring, and cabling complying with TIA-606-B. Comply with requirements in Division 26 Section "Identification for Electrical Systems."
- B. Comply with requirements in Division 09 Section "Interior Painting" for painting backboards. For fire-resistant plywood, do not paint over manufacturer's label.

- C. Paint and label colors for equipment identification shall comply with TIA-606-B for Class 2 level of administration.
- D. Labels shall be preprinted or computer-printed type.

END OF SECTION 271100

SECTION 27 15 13

COMMUNICATIONS COPPER HORIZONTAL CABLING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Category 5e twisted pair cable.
2. Category 6 twisted pair cable.
3. Category 6a twisted pair cable.
4. Twisted pair cable hardware, including plugs and jacks.
5. Cable management system.
6. Grounding provisions for twisted pair cable.

1.2 COPPER HORIZONTAL CABLING DESCRIPTION

A. Horizontal cabling system shall provide interconnections between Distributor A, Distributor B, or Distributor C, and the equipment outlet, otherwise known as "Cabling Subsystem 1," in the telecommunications cabling system structure. Cabling system consists of horizontal cables, intermediate and main cross-connects, mechanical terminations, and patch cords or jumpers used for horizontal-to-horizontal cross-connection.

1. TIA-568-C.1 requires that a minimum of two equipment outlets be installed for each work area.
2. Horizontal cabling shall contain no more than one transition point or consolidation point between the horizontal cross-connect and the telecommunications equipment outlet.
3. Bridged taps and splices shall not be installed in the horizontal cabling.

B. A work area is approximately 100 sq. ft. (9.3 sq. m), and includes the components that extend from the equipment outlets to the station equipment.

C. The maximum allowable horizontal cable length is 295 feet (90 m). This maximum allowable length does not include an allowance for the length of 16 feet (4.9 m) to the workstation equipment or in the horizontal cross-connect.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

- B. Shop Drawings: Reviewed and stamped by RCDD.
 - 1. System Labeling Schedules: Electronic copy of labeling schedules, in software and format selected by Owner.
 - 2. System Labeling Schedules: Electronic copy of labeling schedules that are part of the cabling and asset identification system of the software.
 - 3. Cabling administration Drawings and printouts.
 - 4. Wiring diagrams and installation details of telecommunications equipment, to show location and layout of telecommunications equipment.
- C. Twisted pair cable testing plan.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For RCDD, Installer, installation supervisor, and field inspector.
- B. Product Certificates: For each type of product.
- C. Source quality-control reports.
- D. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance data.
- B. Software and Firmware Operational Documentation:
 - 1. Software operating and upgrade manuals.
 - 2. Program Software Backup: On USB media.
 - 3. Device address list.
 - 4. Printout of software application and graphic screens.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: Cabling Installer must have personnel certified by BICSI on staff.
 - 1. Layout Responsibility: Preparation of Shop Drawings and cabling administration Drawings by an RCDD.
 - 2. Installation Supervision: Installation shall be under the direct supervision of Level 2 Commercial Installer, who shall be present at all times when Work of this Section is performed at Project site.
 - 3. Testing Supervisor: Currently certified by BICSI as an RCDD to supervise on-site testing.

- B. Testing Agency Qualifications: Certified by BICSI.
 - 1. Testing Agency's Field Supervisor: Currently certified by BICSI as an RCDD to supervise on-site testing.

1.7 COORDINATION

- A. Coordinate layout and installation of telecommunications pathways and cabling with Owner's telecommunications and LAN equipment and service suppliers.

1.8 SOFTWARE SERVICE AGREEMENT

- A. Technical Support: Beginning at Substantial Completion, provide software support for two years.
- B. Upgrade Service: Update software to latest version at Project completion. Install and program software upgrades that become available within two years from date of Substantial Completion. Upgrading software shall include operating system and new or revised licenses for using software.
 - 1. Provide 30 days' notice to Owner to allow scheduling and access to system and to allow Owner to upgrade computer equipment if necessary.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. General Performance: Horizontal cabling system shall comply with transmission standards in TIA-568-C.1, when tested according to test procedures of this standard.
- B. Telecommunications Pathways and Spaces: Comply with TIA-569-D.
- C. Grounding: Comply with TIA-607-B.

2.2 GENERAL CABLE CHARACTERISTICS

- A. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with the applicable standard and NFPA 70 for the following types:
 - 1. Communications, Plenum Rated: Type CMP complying with UL 1685 or Type CMP in listed plenum communications raceway.
 - 2. Communications, Plenum Rated: Type CM, Type CMG, Type CMP, Type CMR, or Type CMX in metallic conduit installed according to

NFPA 70, Article 300.22, "Wiring in Ducts, Plenums, and Other Air-Handling Spaces."

3. Communications, Non-plenum: Type CMR complying with UL 1666.
4. Communications, Non-plenum: Type CMP or Type CMR in listed plenum or riser communications raceway.
5. Communications, Non-plenum: Type CMP or Type CMR in metallic conduit installed according to NFPA 70, Article 300.22, "Wiring in Ducts, Plenums, and Other Air-Handling Spaces."

B. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: 25 or less.
2. Smoke-Developed Index: 50 or less.

C. RoHS compliant.

2.3 CATEGORY 5e TWISTED PAIR CABLE

A. Description: Four-pair, balanced-twisted pair cable, certified to meet transmission characteristics of Category 5e cable at frequencies up to 100 MHz.

B. Products: Subject to compliance with requirements, provide one of the following:

1. AMP NETCONNECT; a TE Connectivity Ltd. company.
2. Belden Inc.
3. CommScope, Inc.
4. General Cable; Prysmian Group North America.
5. Mohawk; a division of Belden Networking, Inc.
6. West Penn Wire.

C. Standard: Comply with ICEA S-90-661, NEMA WC 63.1, and TIA-568-C.2 for Category 5e cables.

D. Conductors: 100-ohm, 24 AWG solid copper.

E. Shielding/Screening: Shall meet County Standards

F. Cable Rating: Plenum.

G. Jacket: Thermoplastic. Color to meet County Standards.

2.4 CATEGORY 6 TWISTED PAIR CABLE

- A. Description: Four-pair, balanced-twisted pair cable, certified to meet transmission characteristics of Category 6 cable at frequencies up to 250MHz.
- B. Products: Subject to compliance with requirements, provide one of the following:
 - 1. 3M.
 - 2. AMP NETCONNECT; a TE Connectivity Ltd. company.
 - 3. Belden.
 - 4. CommScope, Inc.
 - 5. General Cable; Prysmian Group North America.
- C. Standard: Comply with NEMA WC 66/ICEA S-116-732 and TIA-568-C.2 for Category 6 cables.
- D. Conductors: 100-ohm, 23 AWG solid copper.
- E. Shielding/Screening: Shall meet County Standards
- F. Cable Rating: Plenum.
- G. Jacket: Thermoplastic. Color to meet County Standards.

2.5 CATEGORY 6a TWISTED PAIR CABLE

- A. Description: Four-pair, balanced-twisted pair cable, certified to meet transmission characteristics of Category 6a cable at frequencies up to 500MHz.
- B. Products: Subject to compliance with requirements, provide one of the following:
 - 1. 3M.
 - 2. AMP NETCONNECT; a TE Connectivity Ltd. company.
 - 3. Belden.
 - 4. CommScope, Inc.
 - 5. General Cable; Prysmian Group North America.
 - 6. Superior Essex Inc.
- C. Standard: Comply with TIA-568-C.2 for Category 6a cables.
- D. Conductors: 100-ohm, 23 AWG solid copper.
- E. Shielding/Screening: Shall meet County Standards.
- F. Cable Rating: Plenum.

- G. Jacket: Thermoplastic. Pink for POE devices. White for data

2.6 TWISTED PAIR CABLE HARDWARE

- A. Description: Hardware designed to connect, splice, and terminate twisted pair copper communications cable.
- B. Products: Subject to compliance with requirements, provide one of the following:
1. AMP NETCONNECT; a TE Connectivity Ltd. company.
 2. Belden.
 3. CommScope, Inc.
 4. General Cable; Prysmian Group North America.
 5. Hubbell Premise Wiring; Hubbell Incorporated, Commercial and Industrial.
 6. Panduit Corp.
 7. Siemon Co. (The).
- C. Cross-Connect: Modular array of connecting blocks arranged to terminate building cables and permit interconnection between cables.
1. Number of Terminals per Field: One for each conductor in assigned cables.
- D. Patch Panel: Modular panels housing numbered jack units with IDC-type connectors at each jack location for permanent termination of pair groups of installed cables.
1. Features:
 - a. Universal T568A and T568B wiring labels.
 - b. Labeling areas adjacent to conductors.
 - c. Replaceable connectors.
 - d. 24 or 48 ports.
 2. Construction: 16-gauge steel and mountable on 19-inch (483 mm) equipment racks.
 3. Number of Jacks per Field: One for each four-pair cable indicated.
- E. Patch Cords: Factory-made, four-pair cables in 36-inch (900-mm) lengths; terminated with an eight-position modular plug at each end.
1. Patch cords shall have bend-relief-compliant boots and color-coded icons to ensure performance. Patch cords shall have latch guards to protect against snagging.
 2. Patch cords shall have color-coded boots for circuit identification.

F. Plugs and Plug Assemblies:

1. Male; eight position; color-coded modular telecommunications connector designed for termination of a single four-pair, 100-ohm, unshielded or shielded twisted pair cable.
2. Standard: Comply with TIA-568-C.2.
3. Marked to indicate transmission performance.

G. Jacks and Jack Assemblies:

1. Female; eight position; modular; fixed telecommunications connector designed for termination of a single four-pair, 100-ohm, unshielded or shielded twisted pair cable.
2. Designed to snap-in to a patch panel or faceplate.
3. Standard: Comply with TIA-568-C.2.
4. Marked to indicate transmission performance.

H. Faceplate:

1. Four port, vertical single gang faceplates designed to mount to single gang wall boxes.
2. Eight port, vertical double gang faceplates designed to mount to double gang wall boxes.
3. Plastic Faceplate: High-impact plastic. Coordinate color with Section 262726 "Wiring Devices."
4. Metal Faceplate: Stainless steel, complying with requirements in Section 262726 "Wiring Devices."
5. For use with snap-in jacks accommodating any combination of twisted pair, optical fiber, and coaxial work area cords.
 - a. Flush mounting jacks, positioning the cord at a 45-degree angle.

I. Legend:

1. Machine printed, in the field, using adhesive-tape label.
2. Snap-in, clear-label covers and machine-printed paper inserts.

2.7 GROUNDING

- A. Comply with requirements in Section 270526 "Grounding and Bonding for Communications Systems" for grounding conductors and connectors.
- B. Comply with TIA-607-B.

PART 3 - EXECUTION

3.1 INSTALLATION OF TWISTED-PAIR HORIZONTAL CABLES

- A. Comply with NECA 1 and NECA/BICSI 568.
- B. Wiring Method: Install cables in raceways, except within consoles, cabinets, desks, and counters and except in accessible ceiling spaces, attics, and gypsum board partitions where unenclosed wiring method may be used. Support cables with j-hooks in accessible ceiling spaces. Cables ran on top of grid ceilings is not acceptable. Conceal raceway and cables, except in unfinished spaces.
 - 1. Install plenum cable in environmental air spaces, including plenum ceilings.
 - 2. Comply with requirements for raceways and boxes specified in Section 270528 "Pathways for Communications Systems."
- C. Wiring within Enclosures: Bundle, lace, and train cables within enclosures. Connect to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Provide and use lacing bars and distribution spools. Install conductors parallel with or at right angles to sides and back of enclosure.
- D. General Requirements for Cabling:
 - 1. Comply with TIA-568-C.1.
 - 2. Comply with BICSI ITSIMM, Ch. 5, "Copper Structured Cabling Systems," "Cable Termination Practices" Section.
 - 3. Install 110-style IDC termination hardware unless otherwise indicated.
 - 4. Do not untwist twisted pair cables more than **1/2 inch (12 mm)** from the point of termination to maintain cable geometry.
 - 5. Terminate all conductors; no cable shall contain unterminated elements. Make terminations only at indicated outlets, terminals, cross-connects, and patch panels.
 - 6. Cables may not be spliced. Secure and support cables at intervals not exceeding **30 inches (760 mm)** and not more than **6 inches (150 mm)** from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
 - 7. Install lacing bars to restrain cables, prevent straining connections, and prevent bending cables to smaller radii than minimums recommended by manufacturer.
 - 8. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIMM, Ch. 5, "Copper Structured Cabling Systems," "Cable Termination Practices" Section. Use lacing bars and distribution spools.

9. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation, and replace it with new cable.
10. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used for heating.
11. In the communications equipment room, install a 10-foot- (3-m-) long service loop on each end of cable.
12. Provide a 24" service loop at each device in the nearest accessible ceiling space that is not exposed.
13. Pulling Cable: Comply with BICSI ITSIMM, Ch. 5, "Copper Structured Cabling Systems," "Pulling and Installing Cable" Section. Monitor cable pull tensions.

E. Group connecting hardware for cables into separate logical fields.

F. Separation from EMI Sources:

1. Comply with recommendations from BICSI's "Telecommunications Distribution Methods Manual" and TIA-569-D for separating unshielded copper communication cable from potential EMI sources, including electrical power lines and equipment.

3.2 FIRESTOPPING

- A. Comply with requirements in Section 078413 "Penetration Firestopping."
- B. Comply with TIA-569-D, Annex A, "Firestopping."
- C. Comply with "Firestopping Systems" Article in BICSI's "Telecommunications Distribution Methods Manual."

3.3 GROUNDING

- A. Install grounding according to the "Grounding, Bonding, and Electrical Protection" chapter in BICSI's "Telecommunications Distribution Methods Manual."
- B. Comply with TIA-607-B and NECA/BICSI-607.
- C. Locate grounding bus bar to minimize the length of bonding conductors. Fasten to wall, allowing at least a 2-inch (50-mm) clearance behind the grounding bus bar. Connect grounding bus bar to suitable electrical building ground, using a minimum No. 4 AWG grounding electrode conductor.
- D. Bond metallic equipment to the grounding bus bar, using not smaller than a No. 6 AWG equipment grounding conductor.

3.4 IDENTIFICATION

- A. Identify system components, wiring, and cabling complying with TIA-606-B. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."
- B. Paint and label colors for equipment identification shall comply with TIA-606-B for Class 2 level of administration.
- C. Equipment grounding conductors.
- D. Cable and Wire Identification:
 - 1. Label each cable within **4 inches (100 mm)** of each termination and tap, where it is accessible in a cabinet or junction or outlet box, and elsewhere as indicated.
 - 2. Each wire connected to building-mounted devices is not required to be numbered at the device if wire color is consistent with associated wire connected and numbered within panel or cabinet.
 - 3. Exposed Cables and Cables in Cable Trays and Wire Troughs: Label each cable at intervals not exceeding **15 feet (4.5 m)**.
 - 4. Label each terminal strip, and screw terminal in each cabinet, rack, or panel.
 - a. Individually number wiring conductors connected to terminal strips, and identify each cable or wiring group, extended from a panel or cabinet to a building-mounted device, with the name and number of a particular device.
 - b. Label each unit and field within distribution racks and frames.
 - 5. Identification within Connector Fields in Equipment Rooms and Wiring Closets: Label each connector and each discrete unit of cable-terminating and -connecting hardware. Where similar jacks and plugs are used for both voice and data communication cabling, use a different color for jacks and plugs of each service.
- E. Labels shall be preprinted or computer-printed type, with a printing area and font color that contrast with cable jacket color but still comply with TIA-606-B requirements for the following:
 - 1. Cables use flexible vinyl or polyester that flexes as cables are bent.

3.5 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Tests and Inspections:

1. Visually inspect twisted pair cabling jacket materials for NRTL certification markings. Inspect cabling terminations in communications equipment rooms for compliance with color-coding for pin assignments, and inspect cabling connections for compliance with TIA-568-C.1.
 2. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.
 3. Test twisted pair cabling for DC loop resistance, shorts, opens, intermittent faults, and polarity between conductors. Test operation of shorting bars in connection blocks. Test cables after termination but not cross-connection.
- C. Data for each measurement shall be documented. Data for submittals shall be printed in a summary report that is formatted similarly to Table 10.1 in BICSI's "Telecommunications Distribution Methods Manual," or shall be transferred from the instrument to the computer, saved as text files, printed, and submitted.
- D. Remove and replace cabling where test results indicate that they do not comply with specified requirements.
- E. End-to-end cabling will be considered defective if it does not pass tests and inspections.
- F. Prepare test and inspection reports.

END OF SECTION 271513

